Fact Sheet

United States Nuclear Regulatory Commission
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Emergency Planning and Preparedness at Nuclear Power Plants

Background

The Nuclear Regulatory Commission (NRC) reexamined the role of emergency planning for protecting the public in the vicinity of nuclear power plants following the accident at the Three Mile Island nuclear power plant in 1979. The accident pointed out the need for improved planning, response and communication capabilities by Federal, State, and local governments to deal with possible reactor accidents. The NRC now requires that emergency plans include preparations for evacuation or other actions to protect the residents in the vicinity of nuclear plants in the event of a serious incident. The events of Sept. 11, 2001, prompted an increased focus on emergency planning and further review of the issues involved. The NRC's main federal partner in EP is the Federal Emergency Management Agency, part of the Department of Homeland Security.

Nuclear power plant owners, government agencies, state and local officials, as well as thousands of first volunteers and first responders, have worked together for more than 20 years to create a system of emergency preparedness and response that will serve the public well in the unlikely event of an emergency. Since commercial nuclear power plants began operating in the United States, there have been no physical injuries or fatalities from exposure to radiation from the plants among members of the U.S. public. Even the country's worst nuclear power plant accident at Three Mile Island resulted in no identifiable health impacts.

Reasonable Assurance

In the U.S., 104 commercial nuclear power reactors are licensed to operate at 65 sites in 31 states. For each, there are onsite and offsite emergency plans to assure that adequate protective measures are taken to protect the public in the event of a radiological emergency. Federal oversight of emergency planning for licensed nuclear power plants is shared by the NRC and FEMA (now part of the Department of Homeland Security) through a memorandum of understanding. The memorandum is responsive to the President's decision of December 7, 1979,

that FEMA take the lead in offsite planning and response, that NRC assist FEMA in carrying out this role, and that NRC continue its statutory responsibility for the radiological health and safety of the public.

FEMA takes the lead in initially reviewing and assessing offsite planning and response and in assisting State and local governments, while NRC reviews and assesses the onsite planning and response. FEMA findings and determinations as to the adequacy and capability of implementing offsite plans are communicated to the NRC. The NRC reviews the FEMA findings and determinations and makes the onsite findings. NRC then makes a determination on the overall state of emergency preparedness. These overall findings and determinations are used by the NRC to make radiological health and safety decisions before the issuance of licenses and in the continuing oversight of operating reactors.

Before a plant is licensed to operate, the NRC must have "reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency." Reasonable assurance is based on licensees complying with NRC regulations and guidance, as well as licensees and area response organizations demonstrating they can effectively implement emergency plans and procedures during periodic evaluated exercises. As part of the Reactor Oversight Process, the NRC reviews licensees' emergency planning procedures and training. These reviews include regular drills and exercises that assist licensees in identifying areas for improvement, such as in the interface of security operations and emergency planning. Each plant owner is required to exercise its emergency plan with the NRC, FEMA and offsite authorities at least once every two years to ensure State and local officials remain proficient in implementing the plan. Licensees also self-test their emergency plans regularly. Each plant's performance in this area can be accessed through the NRC Web site at this address: http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/index.html.

The NRC's regulations are designed to reduce accident consequences and minimize the public's radiation exposure through protective actions that take into consideration plant conditions, evacuation times, shelter factors, and other conditions that could exist.

Emergency Planning Zones

For planning purposes, the NRC defines two emergency planning zones (EPZ) around each nuclear power plant. The plume exposure pathway EPZ, where the primary concern is exposure to and inhalation of airborne radioactive contamination, extends about 10 miles in radius around a plant. The ingestion pathway EPZ, where the primary concern is radioactive contamination of food and water, is about 50 miles in radius. The size and configuration of the zones may vary from plant to plant due to local emergency response needs and capabilities, based on population, land characteristics, access routes, and jurisdictional boundaries.

Emergency plans are in place for each nuclear power plant, and are designed to minimize potential exposure from possible radioactive contamination during an incident. For the 10-mile EPZ, these actions include sheltering, evacuation, and the use of potassium iodide where appropriate. Protective actions for the 50-mile EPZ include stopping the distribution of contaminated food and water, relocating livestock, and controlling access to the area. Residents living within the 10-mile EPZ receive information on radiation and emergency measures, in formats such as calendars, every year.

Other zones erroneously identified by others include a "peak fatality zone" with a 17.5-mile radius and a "peak injury zone" extending beyond 50 miles. These terms come from a 1982 Sandia National Laboratory report that is unrelated to emergency planning and in no way represents a realistic assessment of accident consequences. The report's authors plainly state the results were never intended to reflect reality or be a basis for emergency planning. Nonetheless, these terms continue to be used and repeated periodically in the media.

Protective Actions

To protect the public from exposure to airborne radioactive contamination, either evacuation or sheltering is considered. Factors that affect this decision can include the weather, competing events, how quickly an incident develops or how short-lived a release of radiation may be. People can be instructed to take shelter in their homes, schools, or office buildings. Depending on the type of structure, sheltering can reduce a person's dose up to 80 percent compared to remaining outside.

Another protective action in the 10-mile EPZ involves potassium iodide (KI), a compound that helps prevent the thyroid, the most sensitive gland, from absorbing radioactive iodine, which is one of several isotopes that could be present in a release from a plant. Blocking radioactive iodine reduces the dose to the gland and therefore lowers the risk of thyroid cancer following a major incident at a nuclear power plant.

In January 2001, the NRC modified its regulations to include considering the use of KI, and the Food and Drug Administration later that year issued guidance on using the compound. Eighteen states have received KI tablets from the NRC for their population within 10 miles of a nuclear power plant. These are: Alabama, Arizona, California, Connecticut, Delaware, Florida, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Vermont, and Virginia. Illinois and Tennessee already had KI programs in place, so 20 of the 33 states eligible to receive the tablets have them. Further information on KI is available on the NRC Web site at:

http://www.nrc.gov/what-we-do/emerg-preparedness/protect-public/potassium-iodide-use.html.

Evacuation Models

Emergency planning at nuclear power plants includes evacuation models, some of which have been implemented during non-nuclear incidents in Iowa, Pennsylvania and elsewhere. These evacuations were made easier by emergency planning expertise gained through plans and exercises for nearby nuclear power plants. These historical examples also demonstrate how well the public can listen to and follow directions in emergency situations.

Evacuation models do not, however, call for completely emptying the 10-mile zone. The plume of radioactive material from a nuclear power plant during a major incident would move with the wind, not in an expanding circle. The plume would also expand and become less concentrated as it travels away from a plant. Therefore, evacuations can be mapped to anticipate the plume path. Generally, a two-mile ring around the plant is evacuated, along with people living in the 10-mile zone directly downwind and slightly to either side of the plume's projected path. This "keyhole" pattern (see Figure 1) helps account for potential wind shifts and fluctuations in the plume's path. (See Figure 2)

Planning at each site includes population-based evacuation time estimates, which local authorities use to help determine traffic control plans and routes for evacuees to follow. These time estimates are affected by factors such as weather, and can therefore play a role in deciding between evacuation and sheltering. The NRC alerted licensees in 2001 to the possible need for updating their estimates due to the results of the 2000 U.S. Census. Local and state officials are required to have emergency notification systems that can alert the public within about 15 minutes from learning of situations at a nuclear power plant requiring action.

The evacuation time estimates involved in emergency planning are not, however, linked to the projected radiation doses that would trigger protective action. Therefore, evacuations that continue past the estimates do not result in people receiving an unacceptable dose. In fact, the protective action doses represent the point at which possible risk from radiation exposure should be weighed against the overall risks (i.e., traffic accidents) involved in moving large numbers of people at once.

Terrorism Issues

In the post-Sept. 11 environment, studies have examined how terrorist-based events might challenge existing emergency planning. The NRC recognized how the revised threat affects emergency planning when it issued Orders to nuclear power plants in February 2002; these Orders include interim measures dealing with how increased security affects implementation of emergency plans. While a terrorist event might alter the initial phases of an event, nothing studied to date suggests terrorists could create a larger or faster release of radioactive material from reactors or spent fuel pools than what the emergency planning basis already considers.

Emergency planning regulations require the rapid notification of the public when a general emergency (the most serious accident category) exists at a plant.

Detailed information about emergency planning and preparedness is contained in NRC regulations, specifically Appendix E of Title 10 in the Code of Federal Regulations, Part 50 and in NUREG-0654 (FEMA-REP-1), a joint publication of the NRC and FEMA published in March 2002, entitled "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants."

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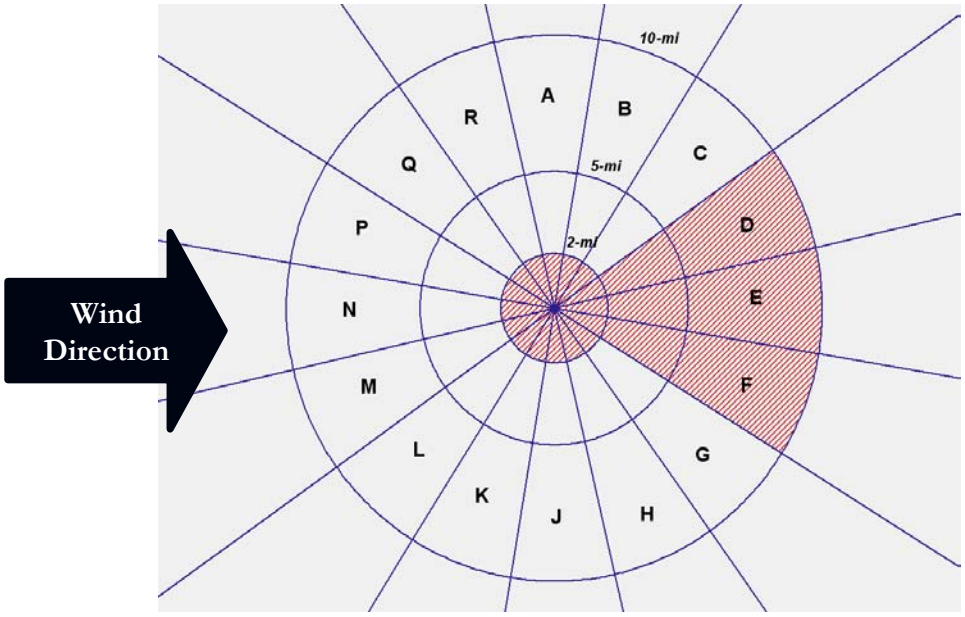

Figure 1 -- "Keyhole" covering 2-mile radius and downwind sectors

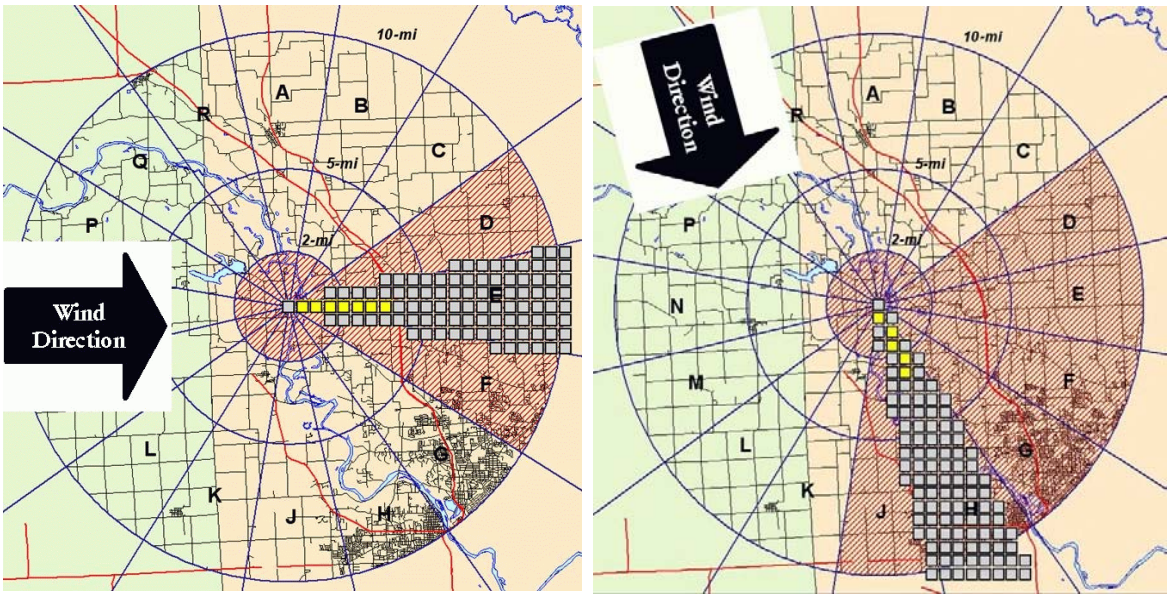

Figure 2 -- Original keyhole (L) and revised keyhole following wind shift (R)